NORTH DAKOTA
DEPARTMENT *of* HEALTH

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MEMO TO   :   File
GTL Energy, Ltd.
GTLE Dakota Plant 1 LLC
Near South Heart, ND
Stark County

FROM   :   Craig D. Thorstenson $CD1$
Environmental Engineer
Division of Air Quality

RE   :   Additional Calculations

DATE   :   April 6, 2009

During the public comment period for the GTL Energy air emission permit, questions were raised regarding the stack gas exit velocities used in the dispersion modeling, carbon dioxide emissions from the facility, fugitive emissions from the buildings at the facility and particulate matter and sulfur dioxide emissions from the emergency generator. The following documents the Department's calculations of the stack gas exit velocities, carbon dioxide emissions and fugitive emissions.

Stack Gas Exit Velocities

The stack gas exit velocities from the stacks at the facility are calculated using the following equation:

$$Q = V \times A$$

Where:

Q = Stack flow rate in actual cubic feet per minute
V = Stack gas exit velocity in feet per minute
A = Area of the stack in square feet

Stack gas exit velocities are calculated as follows:

| Environmental Health Section Chief's Office 701.328.5150 | Division of Air Quality 701.328.5188 | Division of Municipal Facilities 701.328.5211 | Division of Waste Management 701.328.5166 | Division of Water Quality 701.328.5210 |

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Boiler No. 1 (Emission Point No. 1)

$Q = 19,477$ ft³/min
Stack Diameter = 36 inches (3.0 feet)
$A = \pi \times (3 \text{ ft})^2 / 4 = 7.065$ ft²

$Q = V \times A$
$19,477$ ft³/min = $V \times 7.065$ ft²
$V = 2,757$ ft/min = 45.95 ft/sec

Truck Dump Baghouse (Emission Point No. 2)

$Q = 35,000$ ft³/min
Stack Diameter = 44 inches (3.67 feet)
$A = \pi \times (3.67 \text{ ft})^2 / 4 = 10.573$ ft²

$Q = V \times A$
$35,000$ ft³/min = $V \times 10.573$ ft²
$V = 3,310$ ft/min = 55.2 ft/sec

Raw Coal Storage, Handling, Crushing, Conveying and Drying Baghouse (Emission Point No. 3)

$Q = 24,100$ ft³/min
Stack Diameter = 36 inches (3.0 feet)
$A = \pi \times (3.0 \text{ ft})^2 / 4 = 7.065$ ft²

$Q = V \times A$
$24,100$ ft³/min = $V \times 7.065$ ft²
$V = 3,411$ ft/min = 56.9 ft/sec

Coal Dryer Baghouse (Emission Point No. 4)

$Q = 25,508$ ft³/min
Stack Diameter = 38 inches (3.17 feet)
$A = \pi \times (3.17 \text{ ft})^2 / 4 = 7.889$ ft²

$Q = V \times A$
$25,508$ ft³/min = $V \times 7.889$ ft²
$V = 3,233$ ft/min = 53.9 ft/sec

Product Coal Storage and Handling Baghouse (Emission Point No. 5)

$Q = 15,100$ ft³/min
Stack Diameter = 29 inches (2.42 feet)
$A = \pi \times (2.42 \text{ ft})^2 / 4 = 4.597$ ft²

$$Q = V \times A$$
$$15{,}100 \text{ ft}^3/\text{min} = V \times 4.597 \text{ ft}^2$$
$$V = 3{,}285 \text{ ft/min} = 54.8 \text{ ft/sec}$$

Carbon Dioxide Emissions

There are no emissions standards applicable to carbon dioxide emissions; however, the Environmental Protection Agency recently published a proposed rule which will require reporting of carbon dioxide emissions from certain facilities. Carbon dioxide emissions from the GTL Energy facility will result from the combustion of natural gas in the boiler. Maximum potential carbon dioxide emissions from the boiler are calculated as follows:

Carbon Dioxide Emissions (lb/hr)   = 117.65 lb/MM Btu* x 62.8 MM Btu/hr
                                                     = 7,388.4 lb/hr

* Based on AP-42 emission factors.

Carbon Dioxide Emissions (tons/year)   = 7,388.4 lb/hr(8,760 hr/yr)(1 ton/2,000 lb)
                                                          = 32,360 tons/year

Fugitive Emissions From Buildings

Fugitive emissions from the buildings are expected to be negligible. However, fugitive emissions from the crushing are estimated as follows:

Coal Crushing Fugitive PM10 Emissions   = 0.006 lb/ton*(45 ton/hour)(0.1)**
                                                             = 0.027 lb/hr
* Based on emission factors from the EPA FIRE 6.25 Database.
** A 90% control efficiency for the building enclosure is assumed based control factors included in a Texas Natural Resource Conservation Commission Document Titled, "Rock Crushing Plants", dated February 2002.

Although fugitive emissions from an enclosed building are difficult to estimate precisely, based upon the above it appears that fugitive emissions from the building due to crushing of coal will be negligible at less than 0.05 lb/hr. Emissions from the other coal processing activities in the building are also expected to be negligible.

Particulate Matter and Sulfur Dioxide Emissions from the Emergency Generator

$PM/PM_{10}/PM_{2.5}$ Emissions = 4.1 MM Btu/hr(9.50 x 10^{-3} lb/MM Btu) = 0.04 lb/hr

Sulfur Dioxide Emissions = 4.1 MM Btu/hr(5.88 x 10^{-4} lb/MM Btu) = 0.0024 lb/hr

Summary and Conclusions

1) A commenter alleged that the Department increased the exit velocities when modeling emissions from the facility. The stack gas exit velocities used in the Department modeling analysis for Emission Point Numbers 1, 2, 3, 4 and 5 are 45.95 ft/sec, 50 ft/sec, 50 ft/sec, 50 ft/sec and 50 ft/sec, respectively. The stack gas exit velocities based on the above calculations for Emission Point Numbers 1, 2, 3, 4 and 5 are 45.95 ft/sec, 55.2 ft/sec, 56.9 ft/sec, 53.9 ft/sec and 54.8 ft/sec, respectively. It is concluded that the stack gas velocities used in the modeling analysis are less than or equal to the calculated velocities. Therefore, the velocities were not increased by the Department as alleged by the commenter.

   The stack velocities used in the modeling analysis are lower than or equal to the actual expected flow rates. This is expected to result in modeled concentrations which are higher than actual concentrations.

2) Potential carbon dioxide emissions from the facility are estimated to be approximately 32,000 tons/year. There are currently no air quality rules restricting carbon dioxide emissions from the GTL Energy facility. The Environmental Protection Agency has proposed a rule that requires a facility to report carbon dioxide emissions if the emissions exceed approximately 27,560 tons annually. If this rule is finalized, GTL Energy will be required to comply with the applicable reporting requirements of the rule.

3) Fugitive emissions from buildings are expected to be minimal.

4) Particulate matter and sulfur dioxide emissions from the natural gas-fired emergency generator are expected to be minimal.

CDT:saj